

**RESULTS OF THE FIELD STUDY OF THE  
PALEONTOLOGICAL RESOURCES  
OF THE  
FORT CARSON MILITARY RESERVATION,  
COLORADO**

**By**

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## PREFACE

The paleontology survey reported in this manuscript is an important part of the Fort Carson Cultural Resources Management Program whose goal is to maintain the largest possible area for military training while protecting significant cultural and environmental resources. The current study is a demonstration project funded by a grant awarded to Fort Carson by the Legacy Resource Management Program. Congress established Legacy in 1991 to provide the Department of Defense (DoD) with an opportunity to enhance the management of resources on lands under DoD jurisdiction.

The Directorate of Environmental Compliance and Management (DECAM) is tasked with maintaining Fort Carson's compliance with federal, state, and local environmental laws and mandates. The DECAM holistic management philosophy considers that all resources are interrelated such that decisions affecting one resource will impact other resources. The decisions we make today will affect the condition of Department of Army lands and resources for future training, research, and recreation. Mission requirements, training resources, wildlife, range, soil, hydrology, air, and recreation influence management decisions. Integrating compliance and resource protection concerns into a comprehensive planning process reduces the time and effort expended on the compliance process, minimizes conflicts between resource protection and use, allows flexibility in project design, minimizes costs, and maximizes resource protection.

Federal laws protect the resources on Fort Carson and the Pinon Canyon Maneuver Site. Theft and vandalism are federal crimes. Protective measures ensure that Army activity does not inadvertently impact significant cultural and paleontological sites. Fort Carson does not give out site location information nor are sites developed for public visitation. Similar resources are located in the Picketwire Canyonlands where public visits can be arranged through the U.S. Forest Service, Comanche National Grasslands in La Junta, Colorado.

Fort Carson endeavors to make results of the resource investigations available to the public and scientific communities. Technical reports on cultural resources are on file at the Fort Carson Curation Facility (Building 2420) and the Colorado State Historic Preservation Office and are available through the National Technical Information Service, Springfield VA. Selected reports have been distributed to public libraries in Colorado. Three video programs produced by Fort Carson are periodically shown on Public Broadcasting Stations. Fort Carson continues to demonstrate that military training and resource protection are mutually compatible goals.

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March 1999

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## TECHNICAL ABSTRACT

The sedimentary rocks at Fort Carson Military Reservation contain various outcrops of paleontologic significance. Outcrops with significant paleontologic resources range from the Jurassic, Kimmeridgian, Morrison Formation to various undifferentiated Pleistocene alluviums.

The Jurassic stratigraphic sequence consists of the Middle Jurassic Bell Ranch Formation and the overlaying Morrison Formation, which is Upper Jurassic. Only the Morrison Formation has proven to be fossiliferous on Fort Carson. The Morrison Formation is made up of grey-green and red silts, which in the lower 2/3 of the section have common beds of gypsum. Near the contact of the upper 1/3 of the Morrison Formation is a thin fresh water algal limestone that is a marker for this interval on Fort Carson. The upper 1/3 of the Morrison consists of grey-green silts containing swelling clays grading upward into red non-swelling silts. A diverse and significant assemblage of lower vertebrates, fossil wood, and calcitic ichnofossils were discovered near this swelling, non-swelling contact.

The marine Upper Cretaceous sediments at Fort Carson are, in part, very fossiliferous. Many of these fossil localities demonstrate both the geology and paleontology of published localities throughout Colorado, in particular, and also New Mexico, Utah, and Kansas. Eight sites were recorded that have paleontological resources that will add to the scientific understanding of the marine Upper Cretaceous in the Western Interior. The Upper Graneros Shale contains a rare taxon of Elasmobranch, *Ptychodus decurrens*. The Lincoln Limestone Member of the Greenhorn Formation has a site, which contains an unusual solitary coral, various Elasmobranchs, and a diverse invertebrate fauna. The Juana Lopez Member of the Carlile Shale contains a concentration of vertebrate taxa including 17 identified Elasmobranchs and a diverse suite of Osteichthyes fossils. It is likely that new taxa are included in this assemblage. One locality near the Fort Hayes Member and Smokey Hill Member contact of the Niobrara Formation has both Osteichthyes fossils and an Inoceramid that could represent a new taxa or a taxa previously not reported from the Western Interior Seaway. A locality at the contact of the Sharon Springs Member and the Rusty Zone of the Pierre Shale is a small oolitic limestone mass where the nuclei of the oolites frequently consist of bones, teeth, and scales of Osteichthyes. Both the geology and paleontology of this limestone is singular and of the highest scientific interest.

It is recommended that all of the localities that are classified as critical scientific resources should be managed as sensitive sites and that research into these localities should be encouraged.

## POPULAR ABSTRACT

Fort Carson Military Reservation contains a rich and diverse fossil assemblage. This includes animals with backbones, vertebrates, such as dinosaurs, sharks, fish and turtles. Animals without backbones, invertebrates, that have been found at Fort Carson include: clams, oysters, coral, ammonites (an extinct animal related to squids), and snails. Traces of animals are also found in the rocks at Fort Carson. These include the burrows of marine worms and shrimp; also found were the burrowing and nesting structures of insects that lived with the dinosaurs. Fossil wood and fossil plant leaves are also found at Fort Carson. All these fossils represent extinct forms.

The Morrison Formation is world famous for its dinosaur fossils. There are some very interesting Morrison dinosaur sites on Fort Carson. These sites have the large plant-eating dinosaurs called Sauropods and small dinosaurs that are less well known to science. With the dinosaurs are fossil wood, turtles, and traces of insects. This is called a fossil biota and is important to understanding the environment in which the dinosaurs lived.

During part of the time of the dinosaurs a great Inland Sea covered much of the Western Interior of the United States. Many of the sedimentary rocks deposited on Fort Carson were deposited in this seaway. Fort Carson has a rich assortment of fossil sites from this seaway. Some of these sites are of importance to science. These include sites that have rare or new types of animals. At Fort Carson this includes sharks, coral, and a type of clam called an Inoceramid that is either new to science or not previously reported from North America. Coral is rare in the Western Interior Seaway. One site has 17 different types of sharks that have been identified with many more shark and fish fossils that still need to be classified.

These and other marine sites at Fort Carson will add to the scientific understanding of the Western Interior Seaway.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge Debbie Baldwin, Brett Boyer, Gloria McKinney, and Chris Weege for their contributions to the field surveys performed for this report. Government personnel that aided in the fieldwork include Randy Korgel and James Kulbeth of Fort Carson and Melissa Connor of the National Park Service. Paleontological Investigation (PI) would like to extend appreciation to DECAM and the Army for making possible an aerial survey of the geology of Fort Carson. PI would like to especially extend appreciation to Maj. Gen. John M. Riggs, Base commander of Fort Carson, for the concern expressed for this project during a meeting in the field.

Dr. William Cobban, USGS, identified invertebrate taxa and offered valuable discussions regarding the Cretaceous marine in the Western Interior. Dr. Fred Peterson, USGS, contributed useful discussions on the stratigraphy of the Jurassic section including changes in the formational names and their meanings incorporated into this report. Dr. J.D. Stewart, Los Angeles County Museum, contributed to the understanding of the Mesozoic fish of Fort Carson.

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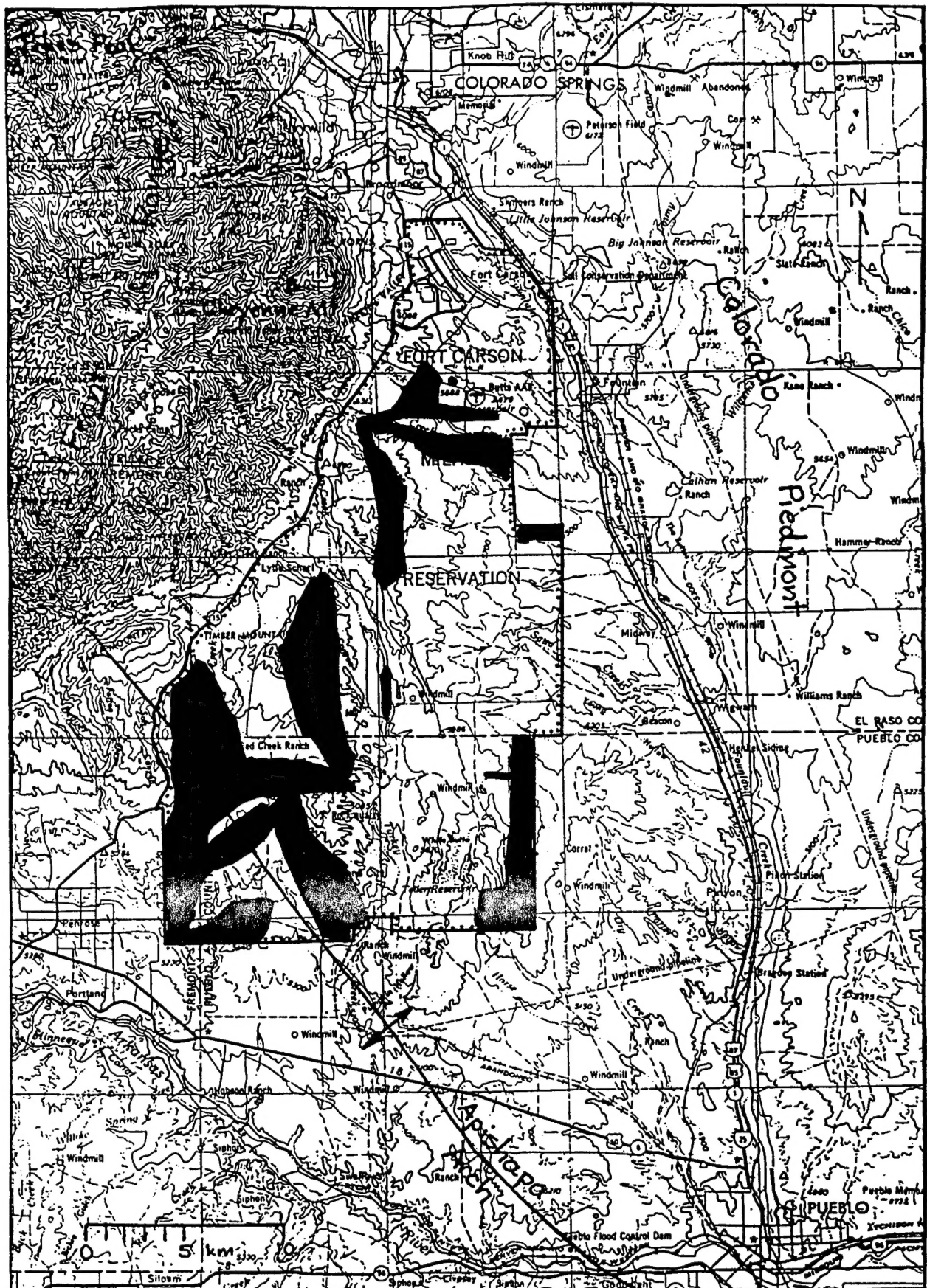
## **INTRODUCTION**

Fort Carson Military Reservation is located on the east side of the Rocky Mountains south of Colorado Springs, Colorado (Map 1). Sedimentary rocks are exposed throughout the Fort. All of the sedimentary rock formations exposed at Fort Carson have produced fossils. Some of these sedimentary rocks are highly fossiliferous. These include much of the marine Upper Cretaceous formations and the terrestrial Morrison Formation. These fossils include vertebrate, invertebrate, plant, and trace fossils. Other sedimentary rock units at Fort Carson are not noted for abundant fossils. These include the Fountain and Lyons Formations, the Dakota Group, and the various Quaternary deposits. This field study is concentrated on the more fossiliferous sedimentary rocks reported at Fort Carson (Carpenter, 1979 and Evanoff, 1996).

The purpose of this report is to: 1) document fossiliferous exposures on Fort Carson and to describe these exposures in their paleontologic and geologic context. 2) Determine the scientific significance of these exposures for land management considerations. 3) Update existing maps of paleontologic significant areas.

## **METHODS**

This project was conducted as a pedestrian survey concentrating on those outcrops deemed of the highest scientific significance by Evanoff (1996) and other outcrops that were observed and deemed to be worth studying during the course of the survey. Particular attention was given to the Upper Cretaceous marine outcrops including the Graneros Shale, Greenhorn Limestone, Carlile Shale, Niobrara Formation, the Pierre Shale and the terrestrial Jurassic Morrison Formation. This fieldwork also attempted to relocate the field sites reported by Carpenter (1979). Fieldwork was performed between 09/23/97 and 09/10/98. Douglas Nelson performed a majority of the fieldwork with assistance from Fred Olsen and Bob Raynolds. Debbie Baldwin, Brett Boyer, Gloria McKinney, and Chris Weege performed additional fieldwork. Small collections were recovered from select sites to: 1) Study the taxonomy of the fossils. 2) Document the scientifically most important sites. 3) Study the taphonomy and geologic environment of sites with unique properties.



Map 1. Fort Carson Military Reservation, Colorado. The areas blacked out were surveyed for this report. After Evanoff (1996)

The pedestrian surveys were conducted by various methods as deemed appropriate to the observed outcrop. All outcrop was initially surveyed by a pedestrian transect of the exposed rock units. When a fossiliferous facies was observed that facies was surveyed laterally throughout the extent of the outcrop. This was not always possible in cases of cliff forming outcrop or steep banked arroyos where field safety would be a concern.

Formations with extensive exposure (over two linear miles) were spot surveyed at selected locations. These formations include the Juana Lopez Member of the Carlile Shale, the Niobrara Formation, and the Pierre Shale excluding the Sharon Springs Member

The Morrison Formation at Dino Hill and the Sharon Springs Member in the area of site 05/31/98-01 were surveyed meter by meter in the potential fossiliferous facies.

Work at PI's offices included: 1) preparation and identification of recovered specimens of both fossils and rocks, 2) thin sections were prepared and studied from a unique fossiliferous facies from the Pierre Shale, 3) acid disaggregation was used on some rocks to free vertebrate fossils, and 4) corrections were made to maps of fossiliferous potential supplied by the National Park Service.

## **STRATIGRAPHY**

The stratigraphy and geology of Fort Carson has previously been reported (Evanoff, 1996). The fieldwork for this paleontological report has, in general, confirmed the work of Evanoff. While geology is not the focus of this report we have updated the terminology and understanding of the Jurassic section at Fort Carson to reflect the contemporary model used for these rocks (Fred Peterson pers. com. 1998; Litwin, 1998; and Peterson & Turner, 1998). This in no way reflects on the elegant understanding of the geology of Fort Carson in Evanoff's report. Other publications that directly concern the stratigraphy and geology of Fort Carson, at least in part, are: Aulia, 1982; Carpenter, 1979; Hassinger, 1959; Krutak, 1996; Orr, 1976; and Pinel, 1977.

The changes to the Jurassic section include the removal of the use of "Ralston Creek Formation" in the Fort Carson area of Colorado and the addition of the "Bell Ranch Formation" for rocks of Middle Jurassic age. The rocks formerly considered to be the Ralston Creek Formation are, in this report, referred to the Lower Morrison Formation. These Lower Morrison rocks are green-grey to red mudstones with common thin beds of gypsum. Some of the gypsum beds can be a meter thick in parts. The Bell Ranch Formation at Fort Carson is made up of red mudstones with common gypsum beds. These beds are



separated from the Morrison Formation by an unconformity (Fred Peterson, pers. com. 1998). The Bell Ranch Formation is considered Middle Jurassic in age (Peterson, 1998; and Litwin, 1998). Previously these rocks of the Bell Ranch Formation were usually considered as the upper part of the Lykins Formation or possibly the lower part of the Ralston Creek Formation

The balance of the stratigraphy observed during the fieldwork for this report agrees with Evanoff's report on Fort Carson (See Fig. 2).

## **PALEONTOLOGIC RESOURCES**

The principal focus of this report is the paleontologic resources observed during the fieldwork conducted by PI at Fort Carson and the evaluation of the scientific significance of those resources.

The scientific significance of any particular fossil site usually depends on a suite of criteria that must be applied to that particular site. These criteria usually include: 1) uncommon or rare taxa present at the site. 2) The geologic setting of the site might be unique or unusual demonstrating an interesting taphonomy and/or paleo-environment 3) Many different taxa present at any one site. 4) Vertebrate fossils are generally considered to be scientifically important. 5) Any site that produces new taxon becomes the type-site for that particular taxon. This study of Fort Carson has produced sites that fit within all the above criteria for scientific significance.

### **Sensitivity Ratings**

The fifty-three sites recorded in this report have been given sensitivity ratings based on the five criteria above. These sites are rated from the highest scientific significance to the insignificant in four categories: "critical", "significant", "important" and "insignificant". This rating system is adapted from the Colorado State "Paleontological Component Form".

### **"Critical" Sites**

The upper part of the Morrison Formation, upper fossiliferous part of the Graneros shale, Lincoln Limestone Member of the Greenhorn Limestone, Juana Lopez Member of the Carlile shale, and the contact between the Sharon Springs Member and the Rusty Zone, (Gilbert, 1897) of the Pierre Shale all produced sites of "critical" sensitivity.

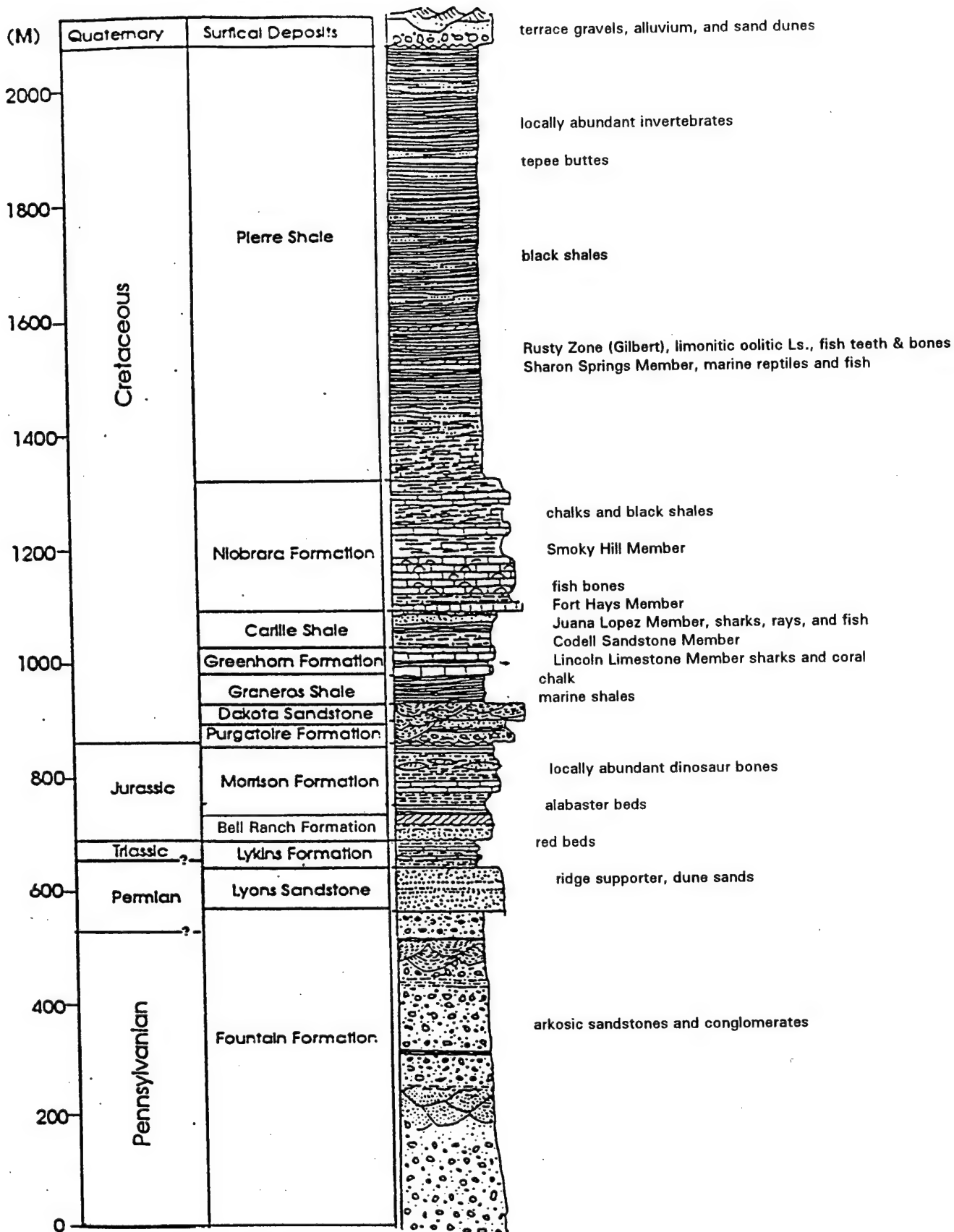


Figure 1. Revised stratigraphic column of the sedimentary rock unit exposed in the Fort Carson Military Reservation. After Evanoff and others (1996).



Fifteen individual sites have been designated with a sensitivity rating of, "critical", (see Appendix A). This designation is based on the scientific significance of these individual sites based on the five criteria above. It should be noted that certain "critical" sites have a further consideration of possible disturbance of these sites that could be destructive of important scientific data. (See sites: 10/05/97-01, 11/07/97-01 and 02/26/98-01)

### **Morrison Formation**

**(Sites: 04/24/98-01, 04/25/98-01, 04/25/98-02, 04/25/98-03, 04/25/98-04, 04/25/98-05, 04/25/98-06)**

The upper part of the Morrison Formation to the north and south of Sullivan Park have important accumulations of dinosaur bone. The south side of Sullivan Park has a grouping of sites on a slope named, in this report, Dino Hill. Sites 04/25/98, 1 through 5 represent a concentration of vertebrate, invertebrate, plant, and trace fossils (Fig. 2).

Dino Hill exposes the Bell Ranch Formation at its base and has exposures of the Lower and Middle Morrison Formation. Near the top of the Middle Morrison or near the bottom of the Upper Morrison is an algal limestone bed. The algal limestone is a thin, no more than 12 centimeters, grey stromatolitic bed. This limestone was observed throughout the Sullivan Park area and serves as a good marker bed. The Upper Morrison has grey-green silts in the exposed lower half and red silts above. Thin limestones and sandstone lenses are present. Fossils are found in both green and red silts that are approximately 20 meters below the contact with the Lytle Formation sandstone. The stratigraphically lowest vertebrate fossil recovered was a scute of the turtle *Glyptops* sp. recovered from a thin limestone. Fossil wood was observed in association with the turtle scute in adjoining silts. The silts resting above this limestone have a rich accumulation of dinosaur bones. Four caudal vertebrae were observed from a diplodocine sauropod (Fig. 3). A scapula from an unidentified sauropod was observed. Several gastroliths and small pieces of petrified wood were found in the same area. The silts also produced calcareous cast trace fossils that are reminiscent of the burrowing structures or nests of unidentified insects.

The rich and varied association of various fossils in one site is of the highest scientific significance. It is also noteworthy that the dinosaur bones we found are in silts that would make quarry work and fossil preparation much more practical than those found in a

more indurated matrix. The Dino Hill sites discussed above are in part, possibly equivalent to Hassinger's Dinosaur Bone site, (Hassinger, 1959).

A survey of the Morrison Formation on the north side of Sullivan Park produced two more sites with dinosaur bones, (04/25/98-06 & 07). This area is mostly vegetated but where outcrop is found there are good vertebrate sites. Fossils that would represent a much smaller animal (10-20 kilos) were observed at 04/25/98-06. These fossils were found in grey-green silts in an exposure of about 1,000 sq. meters. Fossils of smaller lower vertebrate taxa are relatively less common and would indicate that this site should be studied in depth.

The Timber Mountain sections of the Morrison were surveyed for this report. The Morrison in this area is very poorly exposed. This area is heavily vegetated. Most of the outcrops observed were armored with boulders and cobbles of Cretaceous sandstones. The Morrison is often disturbed by gravity slump. The best exposures in the Timber Mountain area were of the Lower Morrison and non-fossiliferous. Only one site from this area was recorded, 09/27/97-01, which had bone fragments and gastroliths.



Figure 2. Morrison Formation exposed on "Dino Hill". A resistant bed of alabaster in the middle Morrison stands out on hillside. The Lytle Sandstone caps the hill. The view is to the east.



Figure 3. Caudal vertebrae of diplodocine sauropod from the silts in the upper Morrison Fm.

Unless future disturbance, artificial or natural, produces better exposure of the Morrison, the Timber Mountain area is not of the highest paleontologic interest.

**The "Little Grand Canyon" upper fossiliferous zone of the Graneros Shale  
(Site: 02/26/98-01)**

The upper fossiliferous unit of the Graneros at this site produced a mass mortality assemblage of ammonites. The taphonomy of this assemblage should be studied in more detail. Also shark teeth of at least three taxa were observed in a thin oyster bed found as float at the base of this large arroyo, (Fig.5). This oyster bed is in a dark shaly limestone. The shark taxa include: *Ptychodus decurrens* (A rare taxon, Welton & Farish, 1993), *Squalicorax curvatus* and a Lamniformes. While the contact of the Lincoln Limestone Member of the Greenhorn Limestone and the Graneros Shale is exposed at this site, (Fig.4), the dark shaly matrix would indicate that the shark teeth are from the Graneros. Attempts to find the oyster bed *in-situ* were not successful during the fieldwork for this report.

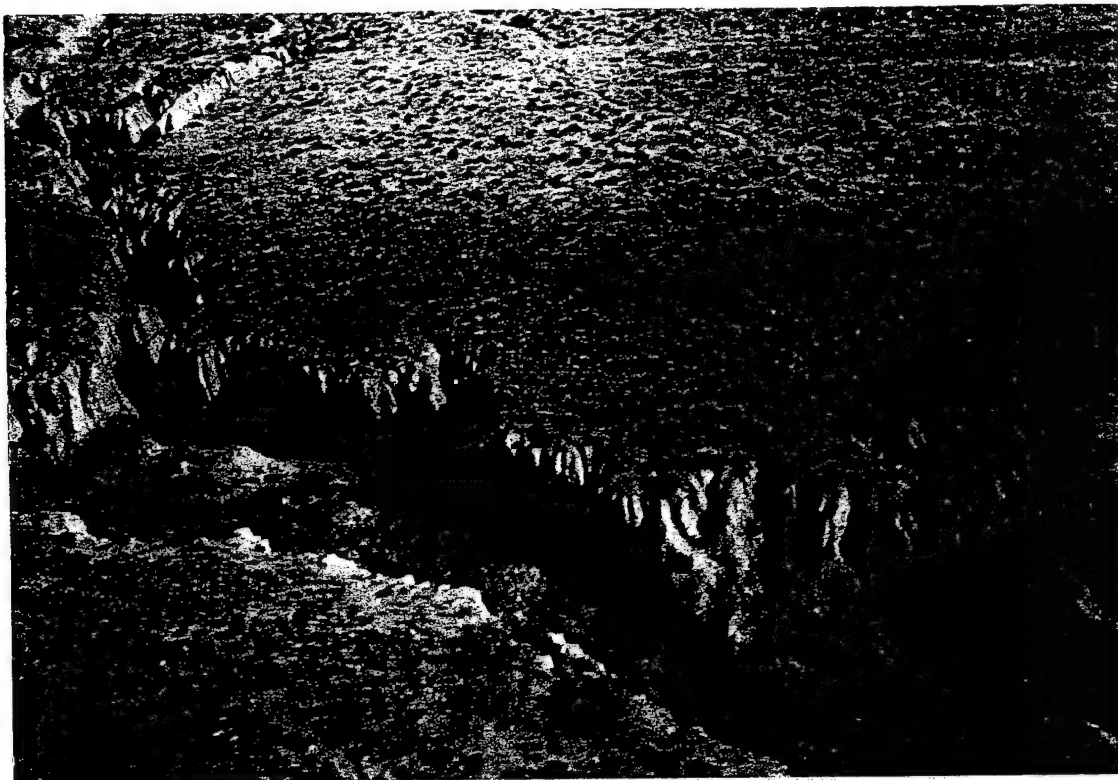


Figure 4. Aerial view of "Little Grand Canyon" shows arroyo in Graneros Shale and Greenhorn Formation. The view is to the south.

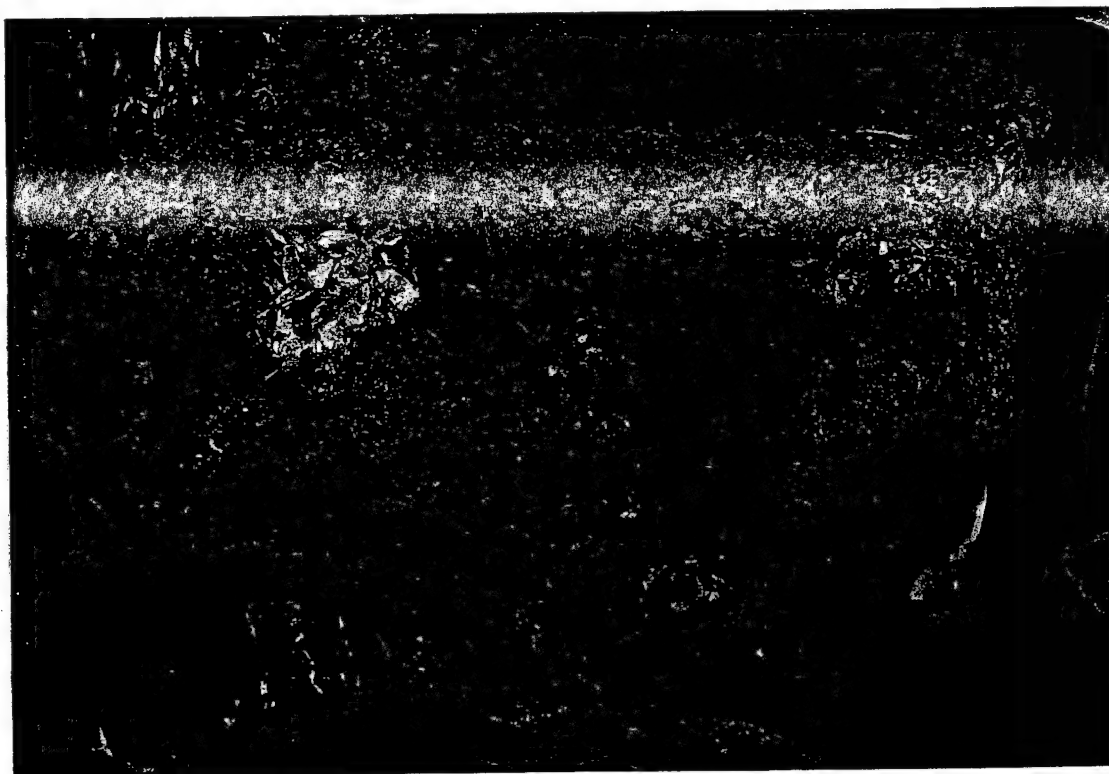


Figure 5. Oyster bed with sharks' teeth, including rare taxon *Ptychodus decurrens*, in shaly limestone.

**Coral Site Lincoln Limestone Member of the Greenhorn Formation**  
( Sites: 11/02/97-01 and 11/02/97-02 )

These sites demonstrate the importance of rare taxa in adding to the understanding of the paleo-ecology of a particular stratigraphic unit. An invertebrate assemblage of ammonites, bivalves (oysters) and a most interesting solitary coral were recovered. Also teeth from two shark taxa were observed: *Squalicorax curvatus*, and a Lamniformes.

Coral is uncommon in the Western Interior Seaway. The discovery of a coral at this site is important. Coral indicates a warm water environment with very little clastic supply. The Lincoln limestone, at this site, is dark brown to grey, flaggy, with ripple marks, and is bioturbated in part. This limestone contains oyster beds associated with the sharks teeth. Further study of this site may produce additional taxa, both vertebrate and invertebrate. Careful mapping and a study of the taphonomy would add to the understanding of the paleo-ecology of this interval of the Greenhorn.

**Juana Lopez Member of the Carlile Shale**  
( Sites: 11/01/97-02 and 07/19/98-02 )

Two sites in the Juana Lopez Member of the Carlile Shale have produced vertebrates and invertebrates of scientific significance, (Fig.7). One site, 11/01/97-02, currently has a recovered faunal list with 26 entries of which 17 are Elasmobranchs. Many other Elasmobranch fossils from this site have yet to be identified. The Osteichthyes include *Encodus* spp. and a diverse assemblage of crushing type dentition including Pycnodontiformes (Nursall, 1993) and other taxa that are currently under study. One invertebrate is of unusual interest; this being a small Echinoidea. Echinoids are rare taxa in the Western Interior Seaway.

Another important Juana Lopez site was discovered at the end of the field season for this report, 07/19/98-02. While this site is rich in vertebrate fossils, disaggregation of matrix has not been possible at the time of this report.

The Juana Lopez is a condensed section of sandstone resting at the top of the Codell Sandstone, (Fig. 6). This contact is a scour surface where present on Fort Carson. The Juana Lopez varies in thickness from about 0.25 meters to 1 meter. Fragments and prisms of Inoceramids are common. The oyster *Lopha ivgubris* is found throughout the section. Phosphate nodules, coprolites, sharks teeth and fish teeth and bones are a normal part of this sandstone. The ammonites *Prinocyclus* spp. are found as casts throughout the Juana Lopez. *P. novomexicanus* has been identified at site 11/01/97-02. The contact between the Juana Lopez and the Fort Hayes Members of the Niobrara Formation is most often weathered and debris covered at Fort Carson.

Geologically the Juana Lopez sandstone has been interpreted as barrier bar and lagoonal sands in a shallow water environment, (Aulia, 1982 and Krutak, 1996). This report can add to that understanding since the taxa reported at Fort Carson, in this report, are considered shallow water dwellers.

All the sharks and rays identified at site 11/01/97-02 are considered shallow warm to temperate water taxa. While modern sharks of the family Mitsukurinidae are deep water animals *Scapanorhynchus raphiodon* as well as other Mitsukurinidae were shallow water taxa until the early Maastrichtian, (Kent, 1994). The fact that *Cretoxyrhina mantelli* is not found at this site is significant. This shark is common in this time period but is interpreted as a deep-water taxa, (J. D. Stewart, pers. com. 1998).

*Rhinobatus incertus* has been identified from this site. This is considered a rare taxon and has not been previously reported from Colorado. Fossils of families Hemiscylliidae and Sclerorhynchidae that have not yet been fully identified may represent new taxa. Many of the identified Elasmobranchs represent extensions of known ranges.

Detailed study of the vertebrate and invertebrate fauna of the Juana Lopez at Fort Carson will increase the understanding of these taxa and the environment in which they existed.



Figure 6. Ridge forming Codell and Juana Lopez sandstone Members of the Carlile Shale are capped by weathered Fort Hays Limestone. View to the east of ridge west of Stone City.

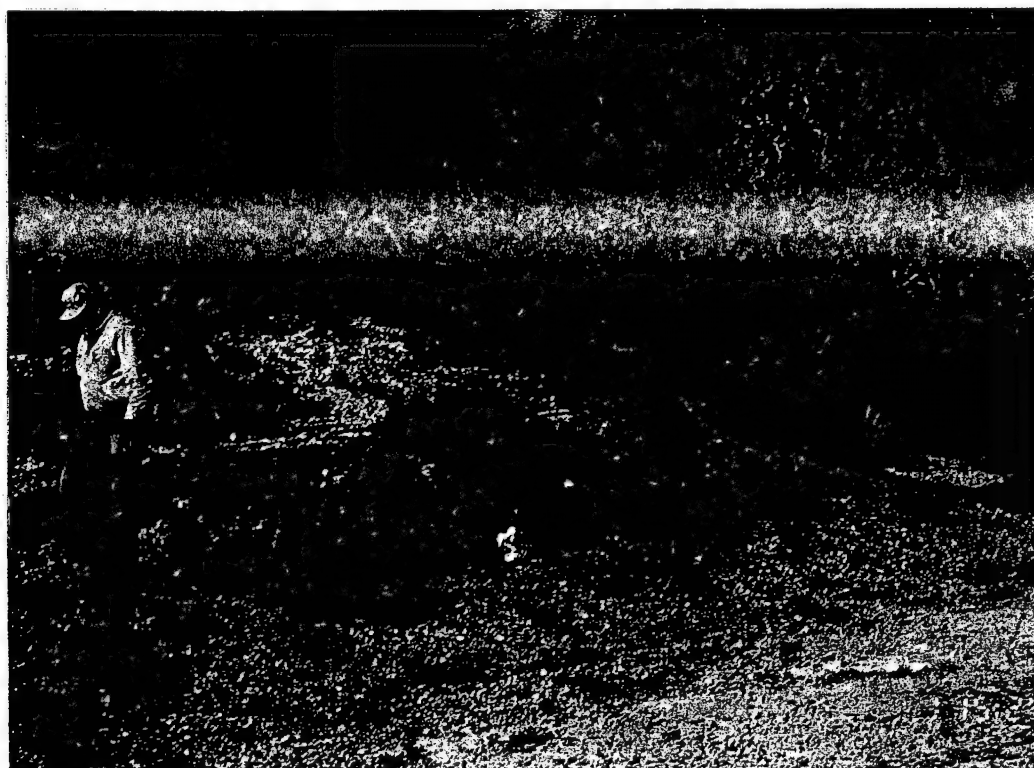


Figure 7. Outcrop of the Juana Lopez Member of Carlile Shale. The Juana Lopez is a limonitic calcarinite that contains a diverse vertebrate biota. View to west from tank trail.



**Niobrara Fish Site**  
( Site: 05/30/98-02 )

This site is in the bank of a modern intermittent stream (Fig.8). The exposure at this location is about six meters of shaly limestone. This limestone is flaggy to massive; dark grey weathering to a very light grey (Fig.9). This limestone contains fish bones, teeth, and scales. A problematic Inoceramid was recovered from this site.

This site is near the contact of the Ft. Hayes Member and the Smokey Hill Member of the Niobrara Formation. The stratigraphic position is uncertain at this time. It is possible that the fish might be of bio-stratigraphic utility (pers. com. J. D. Stewart, 1998). The Inoceramid recovered is not common in the Western Interior Seaway. This fossil could be a new taxon or a taxon not previously recorded from this area. This taxon most closely resembles the European *Cremnoceramus crassus* (pers. com. William Cobban, 1998). Both the fish and the Inoceramid are currently under study.

This is a critical site because it is possibly a type site for a new taxon or the first report of this taxon from the Western Interior Seaway. Further, fish are not common from this interval and the recovered samples will add to our understanding of marine vertebrates.



Figure 8. Water eroded limestone of Niobrara Formation exposed in banks of dry streambed. View to the north.





Figure 9. Rockfall of shaly Niobrara Limestone into dry streambed. Several taxa of fossil fish and an unidentified Inoceramid were recorded from this site.

**Oolite Rock Sites**  
( Sites: 10/05/97-01 and 11/07/97-01 )

The Oolite Rock sites are two sites of critical scientific interest at the contact of the Sharon Springs Member and the Rusty Zone of the Pierre Shale. The principal site, 10/05/97-01, consists of a structure about 3X4 meters on its face, (Fig. 10). This structure is on a steep face and deforms the uppermost layers of the Sharon Springs Member on which it rests (Fig. 11). The upper 2/3 of this rock is a limestone with an iron oxide content that colors this mass red-orange. The limestone is mostly composed of oolites. These oolites are

very roughly divided into two forms that grade into each other. One form is spherical to elliptical with a calcitic core and up to five laminated layers of iron oxide precipitate. The second form has a core of fossil fish bone or teeth sometimes with a calcitic rind and sometime with just various numbers of layers of iron oxide precipitate (Fig. 12). The fossil fish cores can range from microscopic to 3 centimeters. The fish fossils can be teeth, bones and scales. The only taxon noted at the time of this report is Enchodontidae. The lower 1/3 is a highly gypsiferous fissile shale that contains the same fossil fish hash. One piece of fossil wood was observed in these shales. A weathered bentonite is found in these shales. The shales adjoining this mass do not contain the fossils that define this mass.

The second site 11/07/97-01, is about one kilometer north of the first and again is at the contact of the Sharon Springs Member and the Rusty Zone of the Pierre. This site is again a mass on a steep slope. This one is about 3.5X1 meters. There is no hematitic part to this structure. This structure consists of highly gypsiferous shales with an abundant fish hash. The limestone part, if it existed, could have eroded away.

At this time the relation of these two structures remains problematic. No similar structures were found in the opposite walls of either arroyo. Whether these structures represent a long thin connected deposit or are discrete masses awaits further study. These sites present more questions than they answer. This depositional environment is extremely rare in the Western Interior Seaway. Only one other oolitic site has been reported and that is from the Colorado Plateau on the Colorado-Utah border, (Van Wagoner & Bertram, 1995). The taxonomy and taphonomy of the fossils need to be studied in detail. The geology of these structures is unique and at this time enigmatic.

Much effort was placed on surveying the Sharon Springs Member of the Pierre Shale in the area of these sites. The Sharon Springs, in this area, was remarkable for the lack of fossils, (see site, 05/31/98-01).

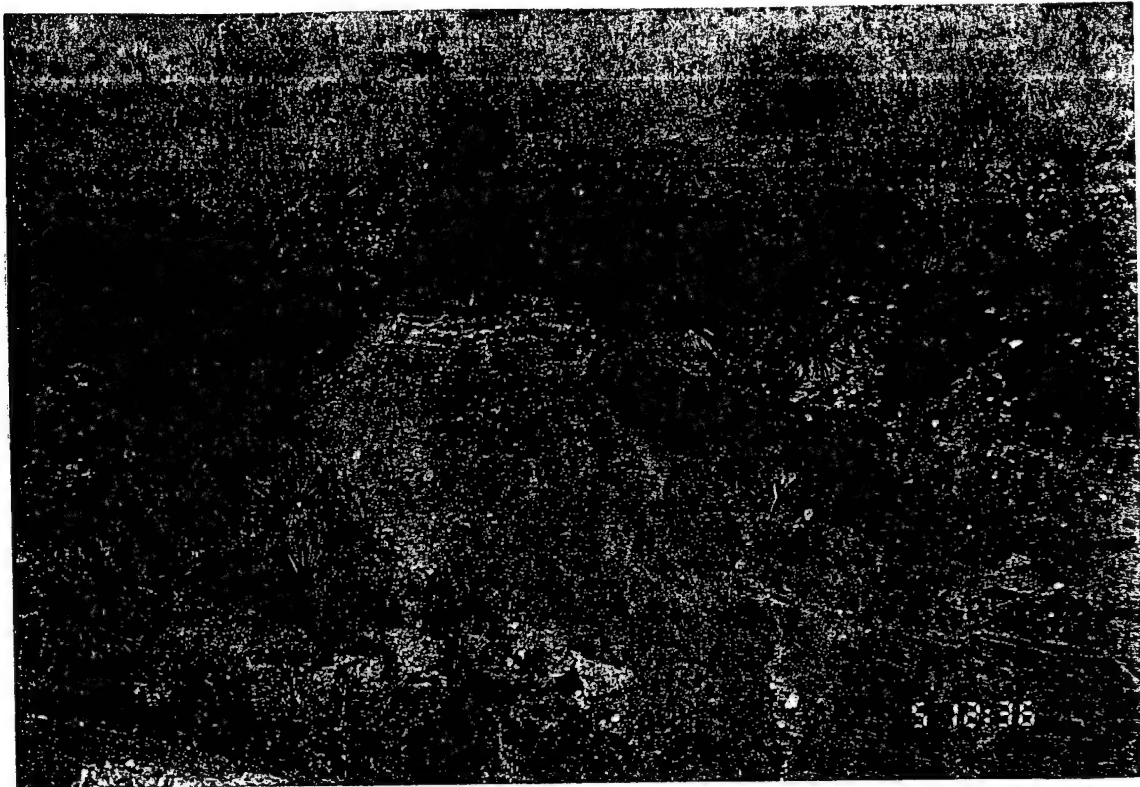


Figure 10. Oolitic limestone exposed at contact between Sharon Springs Member and Rusty Zone of the Cretaceous Pierre Shale. View to the northeast.

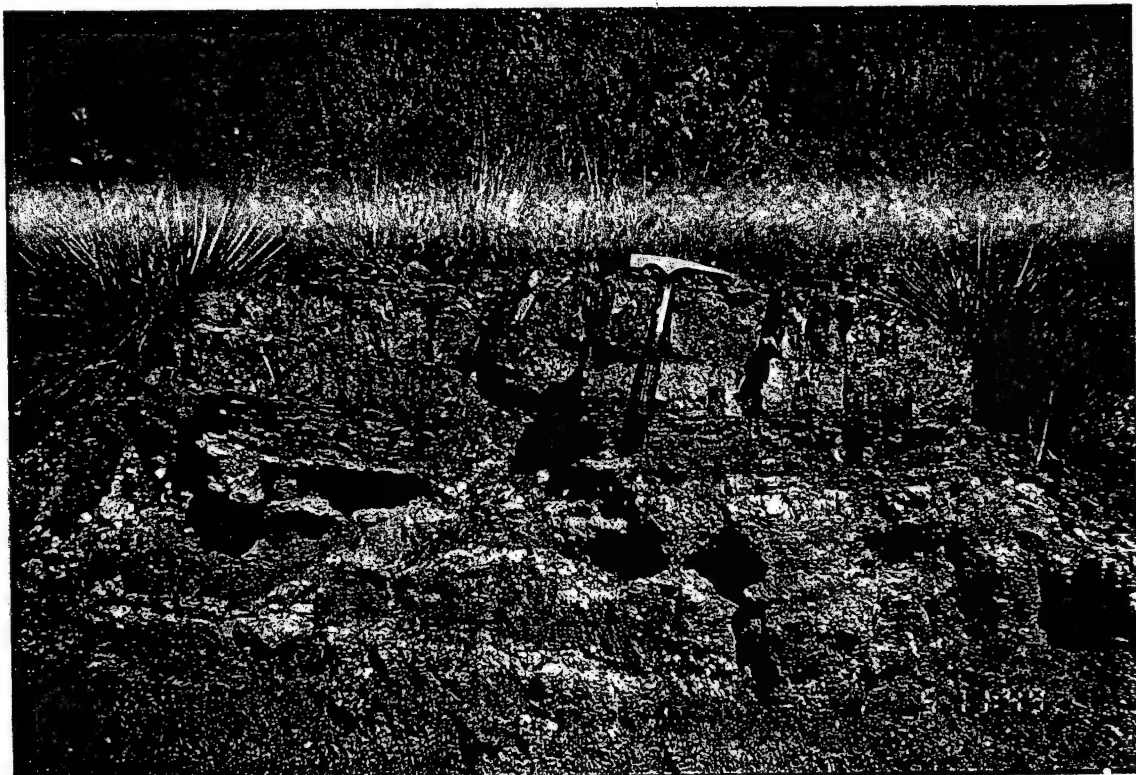


Figure 11. Unique exposure of oolitic limestone, which overlies deformed gypsiferous and bentonitic shales. View to the north.



Figure 12. Photomicrograph, X5, of limonitic oolitic limestone. Many ooids are cored with fish bones and teeth. Cross section of *Encodus* sp. tooth in upper left center of slide.

### Paleontologic Sites of less than "Critical" Sensitivity

Fifty-three sites were recorded during the fieldwork for this report. Thirty-eight of those sites are designated as less than "critical". These thirty-eight sites have been designated "significant", "important", or "insignificant". These sites range from the Jurassic in age to the Pleistocene. For specifics on the paleontology, geology, and other observations see Appendix A of this report.

Fort Carson contains excellent examples of the fossil record from the Upper Morrison, Kimmeridgian through the Pierre Shale, Upper Campanian. Rocks of the Upper Cretaceous, Maastrichtian through Tertiary are not present at Fort Carson. Pleistocene deposits have been sparsely fossiliferous. Stratigraphic units older than the Morrison Formation are present at Fort Carson (see Figure 1), but were not examined for this report.

Fort Carson is rapidly becoming unique in having excellent examples of the geology and paleontology of eastern Colorado in pristine condition. Many traditional sites in this area are rapidly succumbing to urbanization. While many of the sites in this report represent known occurrences of taxa and their geologic setting these sites are a potential resource for future study and education.

### **"Significant" Sites**

**( 09/26/97-02, 09/28/97-02, 10/18/97-02, 11/01/97-01, 11/08/97-01, 04/25/98-07, and 07/18/98-01)**

All seven sites designated as "significant" are of scientific importance but do not meet the criteria necessary for a "critical" designation.

Three sites (09/26/97-02, 09/28/97-02 and 04/25/98-07) have vertebrate fossils but these fossils are both poorly preserved and have a lower potential for further recovery of more interesting specimens.

Site 10/18/97-02 has produced important vertebrate fossils in the past (Carpenter, 1979), though none were observed during this survey. Since this site is in regular use it is possible that vertebrate fossils may be exposed in the future.

Site 11/08/97-01 has an unusual assemblage of vertebrate, invertebrate and plant fossils though the preservation of these fossils is poor. Research at this site may produce interesting information regarding paleo-ecology and taphonomy of the Pierre Shale.

Two sites (11/01/97-01 and 07/18/98-01) are not of the highest scientific interest in themselves but should be included with the study of other sites that have been classified as "critical" sites. Each of these sites is close to another site that is in a higher stratigraphic position. Careful biostratigraphical studies may provide valuable insights in developing a more complete paleo-ecological understanding of these areas. This association has raised the sensitivity of these sites to the "significant" level.

Site (11/01/97-01) is an exposure of the Fort Hayes Member of the Niobrara Formation at the contact of the Juana Lopez Shark Site (11/01/97-02). It is the proximity of this marine vertebrate site to the overlying marine invertebrate site that provides an opportunity for the careful study of the paleo-fauna at these two sites that may produce a more accurate biostratigraphic placement for the interformational contact on Fort Carson. The Juana Lopez site has produced a *Prionocyclus novimexicanus* within .5-meter of the

scour surface contact with the Fort Hayes Member. If an accurate biostratigraphic placement can be determined for the base of the Fort Hayes, then an estimate of the amount of "missing time" represented by the scour surface could be determined.

The strata-containing site (07/18/98-01) can be traced laterally to the hill containing the dinosaur sites at "Dino Hill". A disconformity is generally placed at the contact between the Lytle Member of the Purgatorie Formation of lower Cretaceous age and the Upper Jurassic Morrison. Site (07/18/98-01) is an ideal location to study this contact in context of the fossiliferous "Dino Hill".

#### **"Important" Sites**

(09/23/97-01, 09/27/97-01, 09/28/97-01, 10/04/97-01, 10/11/97-02, 10/11/97-03, 10/18/97-01, 10/19/97-01, 10/19/97-02, 10/19/97-03, 10/23/97-01, 10/23/97-02, 11/02/97-03, 11/07/97-02, 11/20/97-01, 11/21/97-01, 11/21/97-02, 11/25/97-01, 11/26/97-01, 02/24/98-01, 02/24/98-02, 02/25/98-01, 05/31/98-01, 07/04/98-01)

Twenty-four sites have been given a sensitivity rating of "important" in this report. A majority of these sites have common invertebrate fossils in good association with the geology of the individual sites. These fossils and the geology associated with them have been described from other sites in the Front Range of Colorado. Listing these sites as "important" means that good examples of both the paleontology and geology are found at these sites, but nothing observed at these sites can be considered unique or rare.

Two sites, (11/25/97-01 and 05/31/98-01) designated as "important" are placed in this sensitivity rating for reasons other than the above criteria.

Site 11/25/97-01 has poor preservation but many individuals of a juvenile baculite. These common juveniles may represent an interesting paleo-ecological facies suitable for further research.

Site 05/31/98-01 is a section of the Sharon Springs Member of the Pierre Shale. A meter by meter pedestrian survey of the Sharon Springs outcrop in this area was conducted. Only one small fish vertebra was observed. This is unusual since the Sharon Springs Member is noted for its vertebrate fossils. This site has a sensitivity of "important" since future surveys of the Sharon Springs may produce vertebrate fossils exposed by weathering.

### **"Insignificant" Sites**

( 09/26/97-01, 10/11/97-01, 11/08/97-02, 11/08/97-03, 11/08/97-04, 11/25/97-02, 05/30/98-01 )

Seven sites have been given a sensitivity rating of "insignificant". In general, the rating of "insignificant" denotes that these sites are depauperate in fossil taxa and those fossils observed are so poorly preserved that they don't represent specimens that are useful for specific identification.

The fossil log observed at site 05/30/98-01 not only meets the above criteria but also was not found *in situ*. The loss of the geologic context for fossil remains generally denotes a sensitivity of "insignificant".

### **Results of the Survey of Fort Carson Military Reservation**

The reports of Carpenter, (1979) and Evanoff, (1996) indicate that Fort Carson Military Reservation would produce fossils of scientific significance. Both of these reports suggest that the Morrison Formation and the Sharon Springs Member of the Pierre Shale could produce valuable vertebrate fossil resources.

The Sharon Springs Member was identified in the area of site 05/31/98-01. A meter by meter pedestrian survey of the Sharon Springs outcrop was conducted with disappointing results. Only one small fish vertebra was observed. Since the Sharon Springs is noted for fossil vertebrates this result does not meet normal expectations.

The Morrison Formation was surveyed throughout the west side of Timber Mountain. The Morrison north of Sullivan Park, i.e. Timber Mountain, is generally vegetated, armored by large clasts of Dakota Sandstone, covered by Holocene soils, and prone to gravity slumps. This area did not prove to be suitable for good fossil sites within the Morrison Formation. The above statements are also true regarding the Morrison to the west of Camp Red Devil.

The Morrison Formation to the east of Camp Red Devil, in the Sullivan Park area, did produce sites that are of scientific significance. In particular, the area named "Dino Hill" in this report has fossil resources of the highest significance. Dinosaur bones were observed in an excellent geologic context. In association with these fossils are algal beds, turtles, fossil wood, and trace fossils that may represent insect borrows. The paleontology of the Sullivan Park Morrison Formation has not been studied making the Dino Hill sites an important extension of known Morrison sites and a valuable resource for future study.



The marine Cretaceous formations on Fort Carson were, in part, expected to produce common invertebrate fossils. Thirty-five of the fifty-three recorded sites have marine invertebrates. This represents a rich and varied record meeting expectations for known fossiliferous marine rocks on Fort Carson.

Three sites produced invertebrates of particular scientific interest. Site 02/26/98-01 in the upper fossiliferous zone of the Graneros Shale was observed to have a mass mortality assemblage of the ammonite *Acanthoceras amphibolum*. Site 11/02/97-02 in the Lincoln Limestone Member of the Greenhorn Limestone contained a solitary coral, which is a rare occurrence in the Western Interior Seaway. Site 05/30/98-02 in the Niobrara Formation contained a taxon of an Inoceramid that could be a new taxon or a range extension of a taxon that is now known from Europe.

This survey produced a better than expected record of marine vertebrates. The Juana Lopez Member of the Carlile Shale, at Fort Carson, is of particular scientific interest. The site 11/01/97-02 has seventeen identified taxa of Elasmobranchs. Most of these represent the first report of these taxa from Colorado. A few of the fossils from this site may be new taxa. Both the Lincoln Limestone at site 11/02/97-01 and the Graneros Shale at site 02/26/98-01 have Elasmobranch fossils of scientific interest.

Near the contact of the Fort Hayes Member and the Smokey Hill Member of the Niobrara Formation at site 05/30/98-02 Osteichthyes fossils were observed. These fish fossils represent a rare occurrence at this stratigraphic position. Further, these fossils could be valuable bio-stratigraphic indicators (J. D. Stewart pers. com. 1998).

The marine vertebrates observed at Fort Carson are of particular scientific interest and represent a resource of unexpected value.



## **Management Recommendations**

### **General**

All the sites that have been designated as of critical scientific importance may be managed as sensitive sites. Any disturbance to these sites may be monitored by paleontologists. Any collections recovered from these sites should be curated in an institution that will protect these resources in perpetuity. Institutions should follow contemporary guidelines that make these resources easily available for study by the scientific community.

It has been demonstrated, at sites 02/25/98-01 and 10/18/97-02 (see Appendix A), that regular activities at Fort Carson result in the exposure and/or destruction of potentially important fossil resources. All construction areas and maneuver sites might be monitored by paleontologists when these activities could result in disturbance to sensitive formations. This would include formations from the Morrison to the Pleistocene.

Management recommendations are included in each of the individual site reports.

### **Specific**

The sites 10/05/97-01, Oolite Rock and 11/07/97-01, Fish Parts North are in imminent threat of destruction by erosional forces. These two sites may be studied in depth both for their unique geology and paleontology. These studies would ideally result in peer reviewed publication. Collections should be recovered during this study, and curated in an appropriate institution.

The "Little Grand Canyon" site, 02/26/98-01, is exposed in an arroyo that is considered to be a safety hazard. DECAM has plans to fill in this arroyo. Before the arroyo is filled, a study might be conducted that would include the measurement of a detailed stratigraphic column.

This is the best exposure of the contact of the Graneros Shale and the Greenhorn Formation observed at Fort Carson. The oyster bed with sharks' teeth should be identified within the stratigraphic column. Since this bed has produced one rare taxon a larger vertebrate collection should be recovered and studied.

One site described by Carpenter (1979), FC-7, in the Sharon Springs Member of the Pierre Shale is of great scientific interest. This site produced both marine reptiles and fish. At this time the site is closed by the Army. The recovered specimens and documentation have been lost. This site is not included in the site reports since it was closed at the time of this study. Since this is one of the most significant paleontological sites on Fort Carson, it is recommended that if at any time in the future the Army finds that it is safe to enter this area it would be appropriate that this site be studied by a paleontologist and the recommendations of Carpenter (1979) should be followed.

### **Research Recommendations**

Fort Carson contains an abundance of fossil resources suitable for paleontological research. From the Morrison Formation through Pleistocene the field studies for this report have demonstrated a potential for further scientific investigations.

As per the guidelines for the field studies for this report, efforts were concentrated in the Morrison Formation and a survey to locate the Sharon Springs Member of the Pierre Shale. While both these efforts were successful, time to study other formations on Fort Carson was limited. The efforts to survey other fossiliferous sections of Fort Carson produced a number of sites of critical scientific interest. Future surveys could be conducted to fill in the gaps in areas that could not be included in this report. This would include the marine Cretaceous in the Turkey Creek drainage and the Pleistocene alluvium throughout Fort Carson.

Appendix A contains research recommendations pertinent to individual sites surveyed for this report.

### **Specific Research Recommendations**

The Morrison Formation in the Sullivan Park area and in particular those sites at "Dino Hill" should be studied in more depth. These sites offer an excellent opportunity to compile a detailed stratigraphic column. The sequence from the Bell Ranch Formation through the contact of the Morrison Formation and the Lytle Member of the Purgatoire Formation is well exposed along the slope of this hill. The association of multiple dinosaur fossils, turtles, fossil wood, and ichnofossils should be studied as an important record of taphonomy, geology, and paleontology of the Upper Morrison Formation. It should be noted

that the paleontology of the Morrison Fm has not been previously studied in the Fort Carson area.

The Lincoln Limestone Member of the Greenhorn Formation in the area of the sites named, Lincoln Sharks and Lincoln Limestone Coral should be collected in depth to develop as complete a taxa list as possible for these sites. A detailed stratigraphic column from the Graneros Shale to the Bridge Creek Limestone should be constructed. This data should be included with the existing understanding of the vertebrates and rare invertebrate recovered from these sites for this report.

The Bridge Creek Limestone Member of the Greenhorn Formation is well exposed and documented in six individual sites in this report. (See Appendix A). In Evanoff's report on the paleontology of the Pinon Canyon Maneuver Site, (Evanoff, 1998), he referred to Earl Kauffman's report on that Site in reference to the Bridge Creek Limestone, (Kauffman, 1986). Evanoff implied that Kauffman made a significant contribution to the understanding of the Bridge Creek Limestone in that paper. The understanding of the six Bridge Creek Limestone sites at Fort Carson and their management recommendations should be reevaluated in light of Kauffman's report. This report is not available at the time of this writing.

The Juana Lopez Member of the Carlile Fm. has produced a scientifically significant biota at the sites named J.L.'s Sharks and J. L.'s Sharks North. Twenty-six taxa have been documented. The Osteichthyes and Elasmobranchs are currently under study. It is highly likely that new taxa or taxa not previously reported from North America are included in this collection. The current study of these fossils should continue. These studies should be published in a peer reviewed scientific journal.

The Niobrara Formation at Fort Carson has a site of scientific potential named Niobrara Fish. This site has produced one taxon of Inoceramid that is either a new taxon or a taxon not previously reported from North America. This taxon should be studied to determine the identity of this animal. This site has also produced fossils of fish that are currently under study. This study should continue. This site is at an unconstrained interval near the contact of the Ft. Hayes Member and the Smokey Hill Member of the Niobrara Formation. Every effort should be made to identify the position of this site more precisely within the Niobrara Formation

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## **Appendix A**

### **Paleontological Component Forms**

1) Resource No. 09/23/97-01

**PALEONTOLOGICAL COMPONENT FORM**

Northing:

2) TempNo: 1

3) Site Name Little Tepee

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

Pierre Sh

B.scotti zone

Upper Cretaceous

6) Description of Geology and Topography

Limestone "tepee" type form app. 4.5 meters in height. Limestone grey, weathering brown. Mostly grass covered with some good exposure on the west face.

**Specimen**

8) Paleoecologic Inferences

This site preserves the classic "tepee butte" type structure. It has been suggested that these structures represent warm springs on the marine floor.

9) Research Potential/Significance

Work still needs to be done on the nature of these tepee structures. Other areas offer richer resources for this research.

10) Recommendations for Further Work

No further work recommended at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 09/26/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 2 3) Site Name Fred's Dakota Plants

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Plants

5) Formation/Horizon/Geologic Age Dakota Fm. unknown Cretaceous

6) Description of Geology and Topography

The Dakota Sandstone, at this site, forms a resistant dip slope. Masses of plant leaf fossils are found in the sandstone. The fossils are not diagnostic as they display only primary veination.  
This type of leaf fossils in Dakota Sandstone is common throughout the Dakota at Ft. Carson.

**Specimen**

Various plant leaves

8) Paleoecologic Inferences

Fluvial Sandstone with masses of leaf litter.

9) Research Potential/Significance

This site demonstrates a fluvial environment of sandstone deposition.

10) Recommendations for Further Work

No future work required.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/13/98



1) Resource No. 09/26/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 3 3) Site Name Fred's Gastrolith Site

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

Rolling hills of Morrison Fm. silts and thin sandstones. These hills are grass and tree covered. The crowns are armored with broken boulders of Dakota sandstone. The Morrison sandstone, above this site, has casts of vertebrate bones.

**Specimen**

8) Paleocologic Inferences

Green-grey silts of the Morrison Fm. contain fragments of large bones and gastroliths. This indicate large herbaceous dinosaurs in this part of the Morrison.

9) Research Potential/Significance

10) Recommendations for Further Work

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 09/27/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 4 3) Site Name Graneros Hill  
Northing: Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Graneros Shale A. muldoonense zone Upper Cretaceous

6) Description of Geology and Topography

Small (5 meters) hills of non-calcareous grey shales. Bentonite beds throughout these small hills. Jarosite is common.

**Specimen**

Acanthocerus muldoonense

8) Paleoeccologic Inferences

These hills are the Upper Fossiliferous Zone of the Graneros Shale. A. muldoonense is a biostratigraphic zone fossil.

9) Research Potential/Significance

Further finds could add to the list of taxa at this site.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Ft. Carson

16) Recorder DLN

Date 10/9/98

1) Resource No. 09/28/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 5 3) Site Name Tepee Bluff  
Northing: Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Pierre Sh Tepee Zone Upper Cretaceous

6) Description of Geology and Topography

This site is a mostly grass covered bluff running east-west for well over 100 meters. This bluff contains fossiliferous limestone that is equivalent to the limestone that forms tepee structures but no distinctive tepee structures were observed at this site.

**Specimen**

Inoceramus pertennis

Baculites scotti

8) Paleoecologic Inferences

Both the paleontology and lithology of this site is equivalent to the tepee structures that are common in this part of Colorado.

9) Research Potential/Significance

Any exposure of this site, such as construction, would produce a fauna and taphonomy of the tepee limestone.

10) Recommendations for Further Work

No further work required at this time. Any disturbance of this site in the future should be monitored.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/15/98

1) Resource No. 09/28/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 6

3) Site Name Tooth Frag. Site

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate and Invertebrate

5) Formation/Horizon/Geologic Age Pierre Sh Rusty Zone Upper Cretaceous

6) Description of Geology and Topography

Shales typical of the Rusty Zone( Both cone-in cone and ferruginous concretions are present.) are exposed in a bank of a drainage ditch along an Army road.

**Specimen**

Mosasauridae

Baculites sp.

8) Paleocologic Inferences

Vertebrates are not common in the Rusty Zone of the Pierre Shale.

9) Research Potential/Significance

While this is a very limited exposure and one isolated tooth is not of the highest significance it is possible that future erosion ,or any other type of disturbance might produce more vertebrate material that could be of scientific importance.

10) Recommendations for Further Work

This site should be examined periodically to determine if any more vertebrate material is present.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Ft. Carson

16) Recorder DLN

Date 10/15/98

1) Resource No. 10/04/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 7 3) Site Name Melissa's Site

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate, Vertebrate

5) Formation/Horizon/Geologic Age Niobrara/ Smokey Hill Lower Limestone Mb. Cretaceous

6) Description of Geology and Topography

This site is a wooded area on typical chalky limestone of the Lower Limestone Mb. of the Smokey Hill Niobrara.

**Specimen**

Inoceramus subquadratus cren.

Pseudoperna congesta

fish scales

8) Paleoecologic Inferences

This site demonstrates normal warm water marine conditions.

9) Research Potential/Significance

This site extends, laterally, both the lithology and paleontology of Scott and Cobban(1964) as to the Lower Limestone unit of the Smokey Hill Mb. of the Niobrara Fm.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Ft. Carson

16) Recorder DLN

Date 10/15/98

1) Resource No. 10/05/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 8

3) Site Name Oolite Rock

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate

5) Formation/Horizon/Geologic Age

Pierre Sh

Base B. perplexus Z.

Upper Cretaceous

6) Description of Geology and Topography

This site is an important and unique depositional environment at the contact of the Sharon Springs and the Rusty Zone of the Pierre Shale. This site is a mass of iron oxide stained limestone oolitic rock about 1.5X 2 meters on the exposed face. Fragments of Osteichthyes teeth, bones, and scales are common throughout this rock and form the nucleus of many of the oolites. The beds at the base of this rock are deformed.

**Specimen**

Enchodus sp.

Osteichthyes teeth & bones

8) Paleoecologic Inferences

This site is a unique paleo-environment. Both the concentration of vertebrate fossils and the lithology of the rock are of the highest scientific significance.

9) Research Potential/Significance

The unique nature of this site make this one of the most important sites observed during this survey on Fort Carson.

10) Recommendations for Further Work

This site should be protected from all disturbances natural and artificial. Further study of both the geology and paleontology should be conducted as soon as possible.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Ft. Carson

16) Recorder DLN

Date

10/16/98

1) Resource No. 10/11/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 9 3) Site Name Pierre Hills

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Pierre Sh Upper Cretaceous

6) Description of Geology and Topography

Low hills in the Rusty Zone of the Pierre Shale.

**Specimen**

Baculites sp.

linoceramus sp.

8) Paleoecologic Inferences

N/A

9) Research Potential/Significance

Low. Fissile shale of the Pierre Shale is well exposed but fossils are not common at this site.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/16/98

1) Resource No. 10/11/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 10 3) Site Name Smokey Hill

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Niobrara Fm. Smokey Hill Mb. Upper Cretaceous

6) Description of Geology and Topography

Chalky limestone exposed in drainage ditches along Army road. Biostratigraphy places this location in the Lower Shale Unit of the Smokey Hills Mb. Of the Niobrara Fm., Scott & Cobban (1964).

**Specimen**

Haploscapa grandis

Pseudoperna congesta

8) Paleocologic Inferences

Warm normal marine conditions.

9) Research Potential/Significance

This limestone bed could be measured and placed in context as a marker bed in this unit.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/16/98



1) Resource No. 10/11/97-03

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 11

3) Site Name Eastern Shale Hills

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Niobrara Fm. Smokey Hills Mb. Cretaceous

6) Description of Geology and Topography

This site are weathered round hills of dark shale. That shale is fissile and gypsiferous.

**Specimen**

Pseudoperna congesta

Inoceramus sp.

8) Paleoecologic Inferences

Very large plate like inocermids lived on the benthic surface. Oyster colonies form on these large shells.

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/16/98

1) Resource No. 10/18/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 12 3) Site Name Randy Korgel's Site

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Greenhorn Ls

Middle Bridge Creek

Upper Cretaceous

6) Description of Geology and Topography

Limestone, dark grey weathers to buff/white. Exposed as a ridge forming erosional surface.

**Specimen**

Mytiloides columbianus

Puebloites greenhornensis

Pseudoperna sp.

8) Paleoecologic Inferences

Warm shallow marine environment. Benthic zone oxygenated.

9) Research Potential/Significance

This site is a well constrained bio-stratigraphic marker. Further study should increase the number of taxa from this site.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder DLN

Date 8/29/98

1) Resource No. 10/18/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 13 3) Site Name Randy Korgel's Mammoth

Northing: \_\_\_\_\_

Easting: \_\_\_\_\_

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate

5) Formation/Horizon/Geologic Age unknown unknown Pleistocene

6) Description of Geology and Topography

This site is in an Army firing range on Pleistocene alluvium. Earlier studies by Archeologists have produced parts of Proboscidea tusks.(pers. com. R. Korgel). This location is highly disturbed by Army activities.

8) Paleoecologic Inferences

The alluvium at this site can be expected to produce vertebrate fossils.

9) Research Potential/Significance

good

10) Recommendations for Further Work

This site should be surveyed on a regular basis for future exposure of vertebrate fossils caused by disturbances both artificial and natural.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/20/98

1) Resource No. 10/19/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 14

3) Site Name Road Cut to OP#1

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Pierre Sh B. scotti zone Upper Cretaceous

6) Description of Geology and Topography

This site is a road cut exposure on the south side of an unpaved road to OP#1. Light tan shales with cone-in cone structures are common. B. scotti is common.

**Specimen**

Baculites scotti

8) Paleoecologic Inferences

The lithology and the presence of B. scotti places this site into the lower part of the Tepee Zone of Gilbert(1897).

9) Research Potential/Significance

This site illustrates the understanding of the Pierre Shale of Gilbert (1897) and Scott & Cobban (1975)

10) Recommendations for Further Work

No future work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

10/9/98

1) Resource No. 10/19/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 15 3) Site Name OP#1

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Pierre Sh B. scotti zone Upper Cretaceous

6) Description of Geology and Topography

This site is a artificial cut near OP#1 and exposures near this cut. Grey-green non-fissile shales and iron concretions make up the bed rock at this site. The lithology of this site would suggest that OP#1 is in the lowest part of the Tepee Zone(Gilbert, 1897 and Scott and Cobban, 1975).

**Specimen**

Baculite scotti

Didymoceras archiacianum

bivalves

8) Paleoecologic Inferences

Benthic fauna of some diversity found in fissil shales.

9) Research Potential/Significance

Both the lithostratigraphy and bio-stratigraphy at this site are well constrained.

10) Recommendations for Further Work

No future work required at this time

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Ft. Carson

16) Recorder DLN

Date 10/11/98

1) Resource No. 10/19/97-03

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 16

3) Site Name Little Fountain Creek

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Pierre Sh

Rusty Zone

Upper Cretaceous

6) Description of Geology and Topography

Deep erosion cut Arroyo in the Pierre Shale from the tepee zone through the Rusty Zone. The Shale dips 8-10 degrees to the NE. Olive-grey calcareous and limonite fossiliferous concretions.

**Specimen**

Baculite scotti

Menuites oralensis

8) Paleoecologic Inferences

Dark carboniferous shales accumulated on sea floor.

9) Research Potential/Significance

This site is within the Baculites scotti zone of Cobban. Potential for recovery of good invertebrate specimens.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder Douglas L. Nelson

Date

6/28/98

1) Resource No. 10/23/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 17 3) Site Name Arroyos at Little Fountain

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

(See site 10/19/97 #2) The lithology of this site places it 6-7 meters below the Rusty Zone/ Tepee Zone contact.

**Specimen**

8) Paleoeologic Inferences

9) Research Potential/Significance

Future work could produce more taxa at this contact of the Rusty/ Tepee Zones.

10) Recommendations for Further Work

No future work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 10/23/97-02

## PALEONTOLOGICAL COMPONENT FORM

2) TempNo: 18 3) Site Name Little Fountain Creek Arroyos

Northing:

Easting:

### I. PALEONTOLOGICAL DATA:

4) Type of Locality Invertebrates

5) Formation/Horizon/Geologic Age Pierre Sh Rusty Zone Upper Cretaceous

6) Description of Geology and Topography

Erosional Arroyos cut in drainage of Little Fountain Creek. These arroyos expose the Pierre Shale in the Tepee Zone (top) to the Rusty Zone.

#### Specimen

Ostreidae

Menuites oralensis

Baculites scotti

8) Paleoecologic Inferences

Carbonized plant fossils found in concretions at this site. Menuites sp. found in same concretions.

9) Research Potential/Significance

Rich macro invertebrates allow for accurate bio-stratigraphy. Taphonomic studies would be possible.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

No further work required at this time.

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

### II. ADMINISTRATIVE DATA:

15) Fossil Storage Fort Carson

16) Recorder DLN

Date 9/19/98



1) Resource No. 11/01/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 19

3) Site Name Ft. Hayes at J.L.'s Sharks

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Niobrara Fm.

Fort Hayes Mb.

Cretaceous

6) Description of Geology and Topography

The contact of the Juana Lopez and the Fort Hayes is covered by rubble derived from weathered limestone from the Fort Hayes. The first, in situ, fossils were recovered from the Ft. Hayes ~ 3 meters above the contact. The limestone rubble has trace fossils, nodules of limonite after pyrite, marchisite, and oyster shell fragments. The Fort Hayes Mb., at this site, is equivalent to the Ft. Hayes at Pueblo, Colorado( Scott & Cobban, 1964)

**Specimen**

Inoceramus erectus

8) Paleocologic Inferences

The Fort Hayes Mb. is a warm water benthos.

9) Research Potential/Significance

Further study could refine the biostratigraphy of this site.

10) Recommendations for Further Work

Excavation and removal of the rubble at this site could result in a better constrained biostratigraphy of the contact of the Juana Lopez and Fort Hayes at this significant location.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

10/13/98

1) Resource No. 11/01/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 20 3) Site Name J. L.'s Sharks

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate, Vertebrate

5) Formation/Horizon/Geologic Age Carlile Fm. Juana Lopez Mb. Upper Cretaceous

6) Description of Geology and Topography

The Juana Lopez Mb. at this site is a condensed section of cross-bedded sandstone. The sandstone varies in thickness from 0.5-1.5 meters. The sandstone has pebble clasts, phosphate nodules, a shelly fauna dominated by oysters, casts of plant debris and a varied assortment of shark and bony fish teeth. The Juana Lopez rests on a scour surface at the contact with the Codell Sandstone. The upper contact with the Fort Hayes Mb. of the Niobrara Fm. is eroded and covered at this site. The Juana Lopez sandstone is from a shallow marine barrier sand bars.

**Specimen**

casts of plant debris

Lopha ivgubris

inoceramid fragments & prisims

Pironocycles nuvomexicanus

Ptychodus anonymus

Ptychodus whipplei

Cantioscyllium decipiens

Scapanorhynchus raphiodon

Cretolamna appendiculata

Squalicorax falcatus

Scyliorhinidae

Rhinobatus incertus

Pseudohypolophus mcnultyi

Ischyrrhiza texana

Ptychotrygon hooveri

Ptychotrygon triangularis

Cretorectolobus sp.

Ptychotrygon sp.

Chiloscyllium greeni

Cretodus crassidens

Enchodus sp.

Pycnodontiformes

Ischyrrhiza sp.

Pisces various taxa

Echinoidea

8) Paleoecologic Inferences

The Juana Lopez at this site has a diverse assemblage of marine vertebrate taxa. This is represented by a lag deposit of Elasmobranch and Osteichthyes teeth and bones.

9) Research Potential/Significance

This site has produced more taxa of marine vertebrates than have been reported on from the state of Colorado for the Turonian.

1) Resource No. 11/01/97-02

**PALEONTOLOGICAL COMPONENT FORM**

10) Recommendations for Further Work

This site has produced more taxa of marine vertebrates than have been reported on from the state of Colorado for the Turonian.

11) Known Collections/Excavations/Publications/Other Forms

The geology of this site has been published in, Aulia, 1982 and Krutak 1996

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder DLN

Date

10/11/98

1) Resource No. 11/02/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 21

3) Site Name Lincoln Sharks

Nothing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate and Invertebrate

5) Formation/Horizon/Geologic Age

Greenhorn Ls

Lincoln Limestone Mb.

Cenomanian

6) Description of Geology and Topography

Grey limestone, weathering brown, bioturbated, flaggy. Oysters are common. The limestone is muddy with common inocerimid prisms. The limestone forms thin beds( 1-3 meters) separated by shales 2-3 times thicker than the limestones.

**Specimen**

Inoceramus ginterensis

Ostreidae

Squalicorax curvatus

Cretoxyrhina mantelli

Inoceramus prefragilus

8) Paleoeologic Inferences

Warm water environment. The presence of C. mantelli might indicate a deeper water column( J. D. Stewart pers. com.).

9) Research Potential/Significance

The limestone at this site and the adjoining 11/02/97-02 has a rich fauna that would offer a valuable research site.

10) Recommendations for Further Work

Further research at this site is recommend.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/02/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 22

3) Site Name Lincoln Limestone Coral

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

Greenhorn Ls

Lincoln Limestone Mb.

Upper Cretaceous

6) Description of Geology and Topography

Limestone grey, weathering to brown, flaggy with ripple marks. The limestone is bioturbated and contains inocerimid prisms. This limestone bed is separated from 11/02/97-01 by a shale layer. Both limestone beds are app. 1-2 meters thick.

**Specimen**

Inoceramus ginterensis

Ostreidae

Calyoceras canitaurinum

solitary coral

8) Paleoecologic Inferences

Coral is not common in the Western Interior Seaway. This would indicate warm clear water conditions.

9) Research Potential/Significance

Coral is a rare find. The fossil potential at this site is good.

10) Recommendations for Further Work

Further study is highly recommend.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 11/02/97-03

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 23

3) Site Name Bridge Creek Site

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Greenhorn Ls

Middle Bridge Creek

Turonian

6) Description of Geology and Topography

The limestone, at this site, is massive grey, weathering to light grey. The limestone is eroded to cobbles and boulders capping rounded hills.

**Specimen**

Mytiloides columbianus

Vascoceras birchbyi

Watinoceras coloradoense

8) Paleoeologic Inferences

Warm water conditions supporting a varied fauna.

9) Research Potential/Significance

Further study should produce more invertebrate taxa. Both ammonites are good range and zone taxa.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/07/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 24

3) Site Name Fish Parts North

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate

5) Formation/Horizon/Geologic Age

Pierre Sh

Contact, Sharon Springs/Rusty

Upper Cretaceous

6) Description of Geology and Topography

This site is at the contact of the Sharon Springs Mb. and the Rusty Zone of the Pierre Shale. It is about one kilometer north of site 10/05/97-01 and has some similarities to that site. This site is a hash of fish parts in a highly gypsiferous shale. There are not any of the iron oolites as found at 10/05/97-01 but the fish hash is similar. As with 10/05/97-01 this deposit is limited (3X1 meters). It is possible that the iron oolites have been eroded from this site, if they were ever present.

**Specimen**

Osteichthyes teeth & bones

8) Paleoecologic Inferences

This site is unique in it's depositional nature.

9) Research Potential/Significance

This site is of the highest research potential and should be studied for the unique geology and taphonomy of this very limited outcrop.

10) Recommendations for Further Work

This site is highly susceptible to disturbance and erosion. It should be studied as soon as possible in connection with 10/05/97-01.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/07/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 25

3) Site Name B. perplexus Site

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Pierre Sh

Rusty Zone

Upper Cretaceous

6) Description of Geology and Topography

Erosional blowouts in shale hills produce iron cemented concretions with very common baculites.

**Specimen**

Baculites perplexus

8) Paleoecologic Inferences

This site is in shales in the lower part of the Rusty Zone of the Pierre Shale( B. perplexus range zone).

9) Research Potential/Significance

This is a good marker bed and was used, in this survey, to constrain the biostratigraphy of the other sites in this general area.

10) Recommendations for Further Work

No further work required at this time

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder DLN

Date

10/30/98



1) Resource No. 11/08/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 26 3) Site Name Northern Slopes

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate, Vertebrate, Plants

5) Formation/Horizon/Geologic Age Pierre Sh unknown Upper Cretaceous

6) Description of Geology and Topography

Exposed slopes of Pierre Shale as part of a deep cutting erosional arroyo.

**Specimen**

Palm fronds

fish scales

Baculites sp.

Inoceramus sp.

8) Paleoecologic Inferences

Fossils are found in shale concretions. Dark shale environment that could be Sharon Springs Mb. Fossils not diagnostic at this time.

9) Research Potential/Significance

The fossil palm is interesting in this environment. Further study should produce better specimens that could greatly add to the understanding of this site. This site is equivalent to Carpenter's FC-12 site (Carpenter, 1979).

10) Recommendations for Further Work

Further field work should produce important information about this site.

11) Known Collections/Excavations/Publications/Other Forms

Carpenter 1979 and Evanoff 1996

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/08/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 27 3) Site Name Southern Bridge Creek

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age Greenhorn Ls Bridge Creek Upper Cretaceous

6) Description of Geology and Topography

Grey limestone found near base of hills capped with Codell Sandstone and rare broken boulders of Juana Lopez sandstone. Black shales above the limestone are often armored with sandstone boulders.

**Specimen**

Ostreidae

8) Paleoecologic Inferences

Oyster beds in limestone.

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date 10/30/98

1) Resource No. 11/08/97-03

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 28

3) Site Name Ft. Hayes S-E

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Niobrara Fm.

Fort Hayes Mb.

Coniacian

6) Description of Geology and Topography

Surface at this site is armored with broken massive boulders and cobbles of Ft. Hayes limestone.

**Specimen**

Inoceramus erectus

Ostreidae

8) Paleocologic Inferences

Normal warm marine conditions.

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/08/97-04

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 29

3) Site Name Smokey Hill Shale

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

Invertebrate

5) Formation/Horizon/Geologic Age

Niobrara Fm.

Smokey Hill Mb.

Upper Cretaceous

6) Description of Geology and Topography

Shale hills dark grey, fissile with thin bentonites. Inoceramids up to one meter in diameter with oysters growing on the shells.

**Specimen**

Inoceramus sp.

Ostreidae

8) Paleoecologic Inferences

Low oxygen environment with soft surfaced sea floor.

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/20/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 30 3) Site Name Ft. Hayes Road Cut

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

This site is a road cut that has an excellent exposure of rocks from dark shales of the Carlile Fm/ Blue Hill Shale Mb. to the Niobrara Fm./ Ft. Hayes Mb. This is one of the best exposures of this interval found on Fort Carson. No fossils were found in the Blue Hill Shale. The Codell and Juana Lopez sandstones are bioturbated. The Juana Lopez has sparse sharks' teeth. The lowest 6 meters of the Ft. Hayes is rubble covered. Above this point good Inoceramids were recovered.

**Specimen**

Cremnocerimus deformis	
Cremnocerimus inconstance	
Cremnocerimus rotundatus	

8) Paleoecologic Inferences

The Ft. Hayes fossils represent a normal marine benthic environment.

9) Research Potential/Significance

This road cut offers a good example of the geology of the exposed interval.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder  Date

1) Resource No. 11/21/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 31

3) Site Name Bridge Creek inocerimids #1

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Invertebrate

5) Formation/Horizon/Geologic Age

Greenhorn Ls

Bridge Creek Mb.

Upper Cretaceous

6) Description of Geology and Topography

Grass covered slopes below cliff forming sandstones. Thin limestone beds exposed as non-vegetated part of slopes.

**Specimen**

Mytiloides mytiloides

8) Paleoeologic Inferences

Normal marine conditions. M. mytiloides very common.

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder DLN

Date

10/30/98

1) Resource No. 11/21/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 32 3) Site Name Bridge Creek inocerimids #2

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

Greenhorn Ls

Middle Bridge Creek

Turonian

6) Description of Geology and Topography

Thin limestone beds exposed on a grass covered slope below cliff forming sandstones. This site is equivalent to Bed 97 at Pueblo, Colorado of the Middle Bridge Creek ( pers. com. William Cobban). See Cobban & Scott, 1972 p. 23.

**Specimen**

8) Paleoecologic Inferences

Normal marine conditions with a very common fauna of *M. columbianus*

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 11/25/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 33 3) Site Name Pierre Place

Nothing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

Hills of Pierre Shale most likely low in Pierre either Sharon Springs or lower. Shale has a strong hydrocarbon odor. At this site are bioturbated shales with a fossil hash just above containing plant debris, small( juvenile) Baculites, small inocerimids, and large fish scales. The rest of the Pierre Shale in this area is remarkably non-fossiliferous.

**Specimen**

plant hash	
Inoceramus sp.	
Baculites sp.	
fish scales	

8) Paleoecologic Inferences

The juvenile invertebrates are interesting.

9) Research Potential/Significance

The taphonomy of this site should be studied.

10) Recommendations for Further Work

This site could be studied in more depth to determine the significance of the juvenile invertebrates and common plant hash.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder  Date



1) Resource No. 11/25/97-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 34 3) Site Name Range Control

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

**Specimen**

8) Paleoecologic Inferences

9) Research Potential/Significance

10) Recommendations for Further Work

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 11/26/97-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 35 3) Site Name J.L. Cliffs

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

**Specimen**

8) Paleoecologic Inferences

9) Research Potential/Significance

10) Recommendations for Further Work

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 02/24/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 36 3) Site Name J.L. Cliffs #2

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

Juana Lopez is a capping sandstone at a Codell Sandstone cliff. Cross bedding observed in Juana Lopez at this site. Eroded Ft. Hayes above the Juana Lopez.

**Specimen**

Ptychodus whipplei
bivalves

8) Paleoecologic Inferences

Cross bedding in the Juana Lopez observed at this site. Scour surface at base is well exposed.

9) Research Potential/Significance

The geology of this site is important to the understanding of the Juana Lopez at Fort Carson.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 02/24/98-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 37 3) Site Name Bridge Creek North

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

Limestone hills in an area that the Army is actively using for training. The limestone is typical of the Bridge Creek. The Army's activities have increased the exposure in this area.

**Specimen**

8) Paleoeologic Inferences

This site is in the W. coloradoense range zone. Normal warm water marine conditions are inferred at this site.

9) Research Potential/Significance

This site is a good marker bed. More invertebrates could be found.

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 38

3) Site Name Jr. High Construction Site

Northing: Easting: **I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

**Specimen**

8) Paleocologic Inferences

9) Research Potential/Significance

10) Recommendations for Further Work

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown**II. ADMINISTRATIVE DATA:**15) Fossil Storage 16) Recorder 

Date

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 39 3) Site Name Little Grand Canyon

Northing: Easting: **I. PALEONTOLOGICAL DATA:**4) Type of Locality 5) Formation/Horizon/Geologic Age   

6) Description of Geology and Topography

Erosional arroyo cutting through, from top to bottom: 1) 8 meters of the Lincoln Limestone Member of the Greenhorn Limestone  
 2) marker bentonite at the Greenhorn/Graneros contact 3) Upper Graneros, 10 meters exposed.

**Specimen**

8) Paleocologic Inferences

A. amphibolum was found in a mass death assemblage 7 meters below a bentonite bed. O. beloiti is also present at this level. This death assemblage is in the dark non-calcareous shale of the Upper Graneros. The sharks teeth were found in a shale oyster bed as float in the bottom of the arroyo. This oyster bed contains thin layers of pieces of Inocerimid shell and prisms. The sharks teeth are in these thin layers. The provenance of these shark teeth is uncertain at this time. The shale matrix might indicate that this assemblage is from the Graneros. P. decurrens is a rare taxa.

9) Research Potential/Significance

A. amphibolum mass mortality site should be studied to document this site's taphonomy and geologic context. The horizon producing the oyster beds with shark should be found and researched. This site is ideal for a detailed geologic section including at least two scientifically important fossil sites. This is the best exposure of the contact of the Graneros and the Greenhorn at Fort Carson.

10) Recommendations for Further Work

This site should be studied in detail, before DECAM fills in this erosional arroyo as per current plans. This site is designated as "Critical" because this site is going to be destroyed. This site is of scientific importance based on the vertebrates recovered and the taphonomy of the ammonite mass mortality site.

11) Known Collections/Excavations/Publications/Other Forms

James Kulbeth, DECAM Rangeland Management Specialist, brought this site to the attention of this survey.

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown**II. ADMINISTRATIVE DATA:**15) Fossil Storage 16) Recorder Date

1) Resource No. 04/24/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 40 3) Site Name Dino Hill #1

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

Hills on south side of Sullivan Park. Base of this exposure is the Owl Canyon Fm. The steep slopes with silts and common gypsum layers are the Lower and Middle Morrison Fm. The Upper Morrison are grey-green silts grading into red silts above. The grey-green silts contain thin beds of fresh water limestone some with algal structures. Thin beds of sandstone are present in the Upper Morrison. These hills are capped with sandstone of the Lytle Mb. of the Purgatorie Fm. ( see 07/18/98-01)

**Specimen**

8) Paleocologic Inferences

Dino bone frags in Upper Morrison silts. There are no associated Morrison sandstones at this site.

9) Research Potential/Significance

Very Good.

10) Recommendations for Further Work

A very detailed survey of this area is highly recommended.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 04/25/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 41 3) Site Name Dino Hill #2

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

( see 04/24/98-01 for general description.) Thin beds of fresh water limestone with a scute of a turtle and silts with fragments of fossil wood.

**Specimen**

8) Paleoeologic Inferences

The fresh water limestone is non-algal with a small shelly fauna; possible ostracods and gastropods. The Glyptops scute is in this limestone. This would indicate a fresh water pond type environment.

9) Research Potential/Significance

High. The fossil wood has structure and should be studied. The pond environment is an important site.

10) Recommendations for Further Work

Detailed research is highly recommended.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date



1) Resource No. 04/25/98-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 42 3) Site Name Dino Hill #3

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate

5) Formation/Horizon/Geologic Age

Morrison Fm.

Upper Morrison

Jurassic

6) Description of Geology and Topography

( See 04/24/98-01) This site has Dino bone associated with a thin sandstone lens.

**Specimen**

Dino bone frags

gastroliths

8) Paleoecologic Inferences

The taphonomy of this site is a stream deposited bone site. Most likely a distal crevasse splay.

9) Research Potential/Significance

High.

10) Recommendations for Further Work

The sandstone at this site should be uncovered and explored in depth.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage Fort Carson

16) Recorder DLN

Date

11/1/98

1) Resource No. 04/25/98-03

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 43

3) Site Name Dino Hill #4

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

( See 04/24/98-01) This site has silts with a concentration of Dinosaur bones. The silts have small calcareous structures that represent possible insect burrows and/or nesting forms.

**Specimen**

8) Paleocologic Inferences

The possible insect burrows and/or nesting structures would indicate that these silts are a paleosol.

9) Research Potential/Significance

High. This site has the highest potential to produce significant Dinosaur fossils that has been found for this survey. The taphonomy of this site is of scientific importance.

10) Recommendations for Further Work

This site should be explored as a full scale quarry site; both for its scientific potential and the ease of access and operation.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 04/25/98-04

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 44

3) Site Name Dino Hill #5

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Vertebrate

5) Formation/Horizon/Geologic Age

Morrison Fm.

Upper Morrison

Jurassic

6) Description of Geology and Topography

( See 04/24/98-01) This is a Dino Bone site at the contact of the lower grey-green silts and the upper red silts. This site is about 5 meters higher in the section than 04/25/98-03.

**Specimen**

Sauropod

8) Paleoecologic Inferences

This site could be at the boundary of two paleosols. Further study is indicated.

9) Research Potential/Significance

Part of a scapula of a Sauropod found at this site.

10) Recommendations for Further Work

Further exploration is highly recommended.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

11/1/98

1) Resource No. 04/25/98-05

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 45

3) Site Name Dino Hill #6

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

( see 04/24/98-01 ) North facing slopes of Dino Hill. Somewhat vegetated and tree covered.

**Specimen**

8) Paleocologic Inferences

9) Research Potential/Significance

Bone frags are common at this site. None were identified in the field.

10) Recommendations for Further Work

This area should be explored in depth.

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 04/25/98-06

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 46 3) Site Name Little Dino

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

This site is in exposures of silts in a wooded area on the north side of Sullivan Park. The silts at this site are grey-green. Since there are more swelling clays in the silts at this site it is possible that this site could be stratigraphically lower in the Upper Morrison than the Dino Hill sites.

**Specimen**

8) Paleoeologic Inferences

9) Research Potential/Significance

The bone frags observed at this site are from a smaller animal than the sauropods at Dino Hill. It is possible that some of the fossils at this site are from a small Theropod; it would be of interest to determine the taxa represented at this site.

10) Recommendations for Further Work

Further exploration is highly recommended.

11) Known Collections/Excavations/Publications/Other Forms

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 04/25/98-07

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 47

3) Site Name Dino Frags

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

Morrison Fm.

Upper Morrison

Jurassic

6) Description of Geology and Topography

Variegated red and grey-green silts exposed in a west facing slope. These silts are similar in lithology to the fossiliferous silts at Dino Hill sites.

**Specimen**

Dino bone frags

8) Paleoecologic Inferences

N/A

9) Research Potential/Significance

Experience has shown that sites with small bone frags such as this only occasionally produce significant fossils.

10) Recommendations for Further Work

Further exploration would be desirable, but not critical. This general area should be surveyed for better exposures.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 05/30/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 48

3) Site Name Dakota Tree

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

Dakota Fm.

unknown

Lower Cretaceous

6) Description of Geology and Topography

Boulders of Dakota Sandstone capping this part of Timber Mt. A limb cast over 1.5 meters in length found in-situ in a large boulder of Dakota Sandstone.

**Specimen**

fossil wood

8) Paleoecologic Inferences

High energy stream channel sands.

9) Research Potential/Significance

Low

10) Recommendations for Further Work

No further work required at this time.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☐ important ☒ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 05/30/98-02

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 49 3) Site Name Niobrara Fish

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

This site is in the banks of a modern intermittent stream channel. The site is a shaley limestone about 6 meters thick. This limestone is dark grey weathering to a very light grey. It ranges from massive to flaggy.

**Specimen**

Inoceramus sp.	
Enchodus sp.	
Osteichthyes teeth & bones	
fish scales	

8) Paleoecologic Inferences

Benthos at this site would have been a limey mud.

9) Research Potential/Significance

High. The fish fossils are under study and might be bio-stratigraphic indicators. ( pers. com. J. D. Stewart). The Inocerimids at this site are not common in the Western Interior Seaway. They most closely resemble the European taxon, *Cremnoceramus crassus* which is a zone fossil that would be equivalent to the Ft. Hayes/ Smokey Hill contact( pers. com. W. Cobban). The identity of these fossils is under study.

10) Recommendations for Further Work

It is possible that the Inocerimid is a new taxon or a taxon not yet reported from North America. Fish from this interval are not common. Further recovery of fossils and research is highly recommended.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder  Date



1) Resource No. 05/31/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 50

3) Site Name Sharon Springs Fish

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

Erosional valley with both banks and many hillocks of Sharon Springs Shale. The shale is dark grey weathering to a light silver grey. The shale is fissile with small fish scales and large septarian nodules.

**Specimen**

8) Paleoecologic Inferences

This is normal Sharon Springs without the expected vertebrate fossils.

9) Research Potential/Significance

Medium to Low

10) Recommendations for Further Work

Since this is a good exposure of Sharon Springs Shale a careful survey was conducted. The lack of fossils is noteworthy. This site should be re-surveyed in 2-5 years to see if any fossils have been exposed.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder

Date

1) Resource No. 07/04/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 51 3) Site Name Morrison East

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality

5) Formation/Horizon/Geologic Age

6) Description of Geology and Topography

This site is towards the east end of Sullivan Park. The slopes on the south contain Morrison silts; but these slope are vegetated and armored with rubble from the Dakota Sandstones.

**Specimen**

Dino bone	
Algal limestone	

8) Paleoecologic Inferences

The algal limestone observed at this site is the same as at the Dino Hill sites. This limestone is, one way or the other, near the contact of the Middle and Upper Morrison throughout the Sullivan Park area. This is an ideal marker bed for this area.

9) Research Potential/Significance

Low to Medium. While dino bone was observed at this site the vegetated and armored nature of the surface is less than ideal

10) Recommendations for Further Work

Any disturbance, natural or man-made, should be examined for potential fossils.

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☐ significant ☒ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage

16) Recorder  Date

1) Resource No. 07/18/98-01

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 52

3) Site Name Bob's Lytle Wood

Northing:

Easting:

**I. PALEONTOLOGICAL DATA:**

4) Type of Locality Plants

5) Formation/Horizon/Geologic Age

Purgatorie Fm.

Lytle Mb.

Lower Cretaceous

6) Description of Geology and Topography

This site is near the contact of the Morrison and the Lytle in the Dino Hills area. The Lytle at this site is a pebble conglomerate with common casts of fossil wood and opalized wood.

**Specimen**

fossil wood

8) Paleoecologic Inferences

Stream deposits.

9) Research Potential/Significance

This site should be studied with the sites at Dino Hill as the contact between the Morrison and the Lytle.

10) Recommendations for Further Work

This site should be included with any studies of Dino Hill

11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☐ Critical ☒ significant ☐ important ☐ insignificant ☐ unknown

**II. ADMINISTRATIVE DATA:**

15) Fossil Storage N/A

16) Recorder DLN

Date

11/1/98

**PALEONTOLOGICAL COMPONENT FORM**

2) TempNo: 53 3) Site Name J. L.'s North

Northing: Easting: **I. PALEONTOLOGICAL DATA:**4) Type of Locality 5) Formation/Horizon/Geologic Age   

## 6) Description of Geology and Topography

This site is a highly fossiliferous exposure of the Juana Lopez in the bed of a modern intermittent stream. This stream cuts through the Codell Sandstone, Juana Lopez, and the Fort Hayes; the various rocks are exposed in the banks and stream bed.

**Specimen**

## 8) Paleoecologic Inferences

This section of Juana Lopez is a rich lag of fossil vertebrates.

## 9) Research Potential/Significance

High. Vertebrate fossils are common at this site. Casts of ammonites are more common at this site than at any other exposure of the Juana Lopez observed at Fort Carson.

## 10) Recommendations for Further Work

Material from this site should be disaggregated to recover the concentrations of fossil vertebrates. This stream bed would be an excellent location to measure a section.

## 11) Known Collections/Excavations/Publications/Other Forms

N/A

12) Sensitivity ☒ Critical ☐ significant ☐ important ☐ insignificant ☐ unknown**II. ADMINISTRATIVE DATA:**15) Fossil Storage 16) Recorder Date